

CLAIMS

- 5 1. An indirectly heated cathode ion source comprising:
an arc chamber housing defining an arc chamber having an extraction aperture;
an extraction electrode positioned outside of the arc chamber in front of the
extraction aperture;
an indirectly heated cathode positioned within the arc chamber;
a filament for heating the cathode;
a filament power supply for providing current for heating the filament;
a bias power supply coupled between the filament and the cathode;
10 an arc power supply coupled between the cathode and the arc chamber housing;
an extraction power supply, coupled between the arc chamber housing and the
extraction electrode, for extracting from the arc chamber an ion beam having a beam
current;
an ion source controller for controlling the beam current extracted from the arc
15 chamber at or near a reference extraction current.

- 20 2. An ion source as defined in claim 1 wherein said ion source controller
comprises feedback means for controlling the extracted beam current in response to an
error value based on the difference between a sensed beam current and the reference
extraction current.

- 25 3. An ion source as defined in claim 2 wherein said feedback means comprises
means for controlling a bias current supplied by said bias power supply in response to the
error value.

4. An ion source as defined in claim 2 wherein said feedback means comprises
means for controlling a filament current supplied by said filament power supply in
response to the error value.

5. An ion source as defined in claim 2 further comprising an extraction current
sensor for sensing an extraction power supply current that is representative of the
extracted beam current.

6. An ion source as defined in claim 2 wherein said feedback means comprises a
Proportional-Integral-Derivative controller.

7. An ion source as defined in claim 1 further comprising:
a suppression electrode positioned between the arc chamber housing and the
extraction electrode; and
a suppression power supply coupled between the suppression electrode and
ground.

8. A method for controlling an indirectly heated cathode ion source comprising a
cathode and a filament for heating the cathode, said method comprising the steps of:
sensing a beam current extracted from the ion source; and
controlling a bias current between the filament and the cathode in response to an
error value based on the difference between the sensed beam current and a reference
extraction current.

9. The method as defined claim 8 further comprising steps of:
maintaining a filament current at a constant value; and
maintaining an arc voltage at a constant value;
wherein a filament voltage and an arc current are unregulated.

10. A method for controlling an indirectly heated cathode ion source comprising
a cathode and a filament for heating the cathode, said method comprising the steps of:
sensing a beam current extracted from the ion source; and
controlling a filament current through the filament in response to an error value
based on the difference between the sensed beam current and a reference extraction
current.

11. The method as defined claim 10 further comprising steps of:
maintaining a bias current at a constant value; and
maintaining an arc voltage at a constant value;
wherein a bias voltage and an arc current are unregulated.

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12. A method for controlling an indirectly heated cathode ion source comprising
a cathode and a filament for heating the cathode, said method comprising the steps of:
sensing a beam current extracted from the ion source; and
controlling the beam current extracted from the ion source in response to an error
10 value based on the difference between the sensed beam current and a reference extraction
current.

13. A method for controlling a beam current extracted from an arc chamber
comprising steps of:
15 providing an arc chamber housing defining an arc chamber having an extraction
aperture;
providing an extraction electrode positioned outside of the arc chamber in front of
the extraction aperture;
providing an indirectly heated cathode positioned within the arc chamber;
20 providing a filament for heating the cathode;
providing a filament power supply for providing current for heating the filament;
providing a bias power supply coupled between the filament and the cathode;
providing an arc power supply coupled between the cathode and the arc chamber
housing;
25 providing an extraction power supply, coupled between the arc chamber housing
and the extraction electrode, for extracting from the arc chamber an ion beam having a
beam current;
providing an ion source controller for controlling the beam current extracted from
the arc chamber at or near a desired level, in response to an extraction current supplied by
30 the extraction power supply.